THE SPECIES OF *CHIASTOSELLA* (BRYOZOA).

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(Plate xviii.)

INTRODUCTION.

The species of *Chiastosella* Canu and Bassler, 1934, form a characteristic group from Tertiary to Recent times in southern Australia. Much confusion, however, has been brought about by the misleading figures of the genotype. A search was made in the Macgillivray collection (preserved in the National Museum, Melbourne) for the holotype of *"Schizoporella" daedala* (the genotype), so that accurate comparison with other species could be made.

Five slides labelled *"Schizoporella daedala"* in Macgillivray's handwriting were found, one of them also bearing the name *"insignis"*. This specimen proved to be the holotype, since it is also the only specimen bearing ovicells, which are shown in Macgillivray's figures (1882, 1887). The ectocyst and a large amount of loose granular material mask the calcified structures of the holotype and consequently a small fragment was incinerated in order to reveal the zooecial detail.

The examination of a large series of specimens of *Chiastosella* from the author's collection, the Macgillivray and Maplestone collections in the National Museum (Melbourne) and the South Australian Museum collections has indicated the necessity for the present revision.

The failure to appreciate the variation within both fossil and Recent species which can be brought about by varying degrees of calcification according to the age of the zooecia, the effects of abrasion and the mode of preservation, must inevitably cause endless confusion in the application of the Bryozoa for age determination in Cainozoic deposits. Such "species" erected on growth variations and mode of preservation can give an entirely erroneous conception of the proportion of fossil to Recent species at any particular locality and consequently a valuable source of information on Cainozoic stratigraphy is liable to be neglected.

Key to the Species.

1. Ovicell with grooved crescentic distal border .. .. 2.
   Ovicell lacking grooved distal border .. .. 3.
2. Frontal with median longitudinal ridge .. .. *C. conservata* (Waters).
   Frontal with smooth-rimmed tremopores .. .. 4.
3. Small avicularia surmounting globular bosses .. *C. watersi, sp. nov.*
   Large rounded avicularia with serrated rims .. *C. gabrieli, sp. nov.*
4. About 12 rows of pores in border of ovicell. *C. daedala* (Macgillivray).
   About 18 rows of pores in border of ovicell . *C. porosa* Canu & Bassler.

SYSTEMATIC DESCRIPTION.

Family Schizoporellidae Bassler, 1935.

Subfamily Schizoporellinae Canu & Bassler, 1917.

Genus Chiastosella Canu & Bassler, 1934.

Chiastosella Bassler, 1934, 407.

Type (by original designation): *Chiastosella* (*"Schizoporella"*) *daedala* (Macgillivray, 1887).

Observations.—The study of the species which obviously belong to this group has shown the necessity for certain emendations of the generic diagnosis. All the species are characterized by the hyperstomial ovicell opening above the level of the aperture. The central portion of the ovicell is usually sparsely porous, while the distal margin usually bears a crescentic depression with radiating rows of small pores. Canu and Bassler state that the sinus of the aperture is rectangular. In the genotype it is definitely subcircular, while in the other species its form varies. A single row only of aerolar pores may occur in *Chiastosella.*

Other constant features are the presence of spines on the distal margin of the peristome and the laterally-directed avicularia on the frontal proximal to the aperture. The zoarium in all the species known is unilaminate and either free or encrusting.

CHIASTOSELLA DAEDALA (Macgillivray, 1887).

(Plate xviii., figs. 1, 2.)

Schizoporella insignis Macgillivray (*non* Hincks, 1881), 1883, 132, pl. ii., fig. 11. Hincks, 1884, 281.

Schizoporella conservata Hincks (*non* Waters, 1881), 1882, 165, pl. vii., fig. 2. Stach, 1935, 343, pl. xii., fig. 4.

Schizoporella daedala Macgillivray, 1887, *a,* 180; *idem,* 1887, *b,* 211; *idem,* 1887, *c,* 146, pl. cxxxviii., fig. 4. Jelly, 1889, 225.

Schizoporella vercoi Livingstone, 1928, 117, figs. 32, 33.

Chiastosella daedala (Macgillivray), Bassler, 1934, 407. Not *Schizoporella daedala* Macgillivray, 1895, 84, pl. xi., fig. 15; Maplestone, 1904, 207 = *C. porosa* Canu & Bassler, 1935.

Description.—Zoarium unilaminate, foliaceous; dull-brown in colour when dry. Zooecia rhomboid in outline, usually broader than long.

The aperture, set within a shallow, smooth, subcircular peristome, is semicircular. The transversely oval sinus, limited by inwardly directed cardelles, equals in diameter about one-quarter that of the aperture. A narrow serrated plate, arising in the proximal corners of the aperture below the level of the cardelles, extends along the proximal rim on each side almost to the sinus. The operculum is strengthened by a median banded narrow sclerite, crescentic in outline and with a central unthickened area. The distal margin of the peristome bears four unjointed short spines articulated to circular spine bases.

The frontal is pierced by a varying number of tremopores (14-32) according to the size and number of avicularia on the zooecia. Areolation is often obscure, but, when distinct, a single row of areolar pores is developed. In older zooecia many of the tremopores become closed by calcification.

Large acute avicularia with entire rims occur on one side of the zooecia directed laterally below the level of the proximal rim. A corresponding large avicularium occasionally is developed on the opposite side of the zooecium. Small avicularia of similar type may appear on the proximal region of the frontal.

The triangular ovicell, not raised above the level of the frontal of the distal zooecium, is surrounded distally by a bordered depression containing eleven or twelve radiating rows of two or three small pores. The triangular smooth area distal to the peristome bears two to four large tremopores.

Dimensions.—Zooecium, length, 0.9 mm.; breadth, 1.0; aperture, diameter, 0.30; ovicell, height, 0.40; breadth, 0.55.

Type Material.—Holotype: One zoarial fragment (Nat. Mus., Coll. No. 64,105). Paratypes: Nat. Mus. Coll. Nos. 64,102-04.

Distribution.—Recent: Port Phillip Heads (Victoria); off Beachport at 40 fathoms (South Australia).

Lower Pliocene: Upper beds at Macdonald's on Muddy Creek, Hamilton (Victoria).

Observations.—The inadequate figures and description of this species caused Livingstone (1928) to describe this form as a new species under the name of *Schizoporella vercoi.* His discovery of the intra-apertural serrated plate and an examination of his types confirm its placing with the present species.

CHIASTOSELLA GABRIELI, *sp. nov.*

(Plate xviii., figs. 3, 4.)

Description.—Zoarium unilaminate, white in colour when dry and with the ectocyst intact. Zooecia very large in comparison with the other species, elongate rectangular in outline and more than twice as long as broad.

The large aperture, without peristome, is semicircular, the slightly concave proximal rim being indented by a broad shallow median sinus equalling in diameter about one-fifth that of the aperture. The operculum bears no sclerite. Above the distal rim of the aperture three slender spines, and rarely a fourth, are developed.

The frontal, pierced by a large number of small tremopores, is strongly tuberculate. The lateral and proximal margins of the frontal are deeply areolated, the bounding ridges being strongly salient.

Elongate rounded avicularia of moderate size, and with the outer extremities of their salient rims sharply serrated, occur some distance below the level of the proximal rim directed laterally on one side of the zooecium; rarely an avicularium is present on each side of the zooecium, but often they are absent altogether.

The large longitudinally semi-elliptical ovicell, scarcely projecting above the level of the frontal of the distal zooecium, is deeply areolated, the central portion being tuberculate and pierced by numerous small tremopores. A single spine occurs on each side of the aperture of zooecia bearing ovicells.

Dimensions.—Zooecium, length, 1.30 mm.; breadth, 0.75; aperture, diameter, 0.35; ovicell, height, 0.55; breadth, 0.60.

Type Material.—Holotype: Zoarial fragment (Nat. Mus. Coll. No. 64,101). Paratype: Nat. Mus. Coll. No. 69,639.

Distribution.—Recent: Western Port (Victoria).

Observations.—Specimens of this form, dredged by the late J. Gabriel after whom the species is named, were found in the Macgillivray collection labelled as *"Schizoporella daedala."* They differ from the genoholotype in the large elongate form of the zooecia, the marked areolation, the three spines of the distal rim of the aperture, the rounded serrated character of the avicularia and the lack of the intra-apertural serrated plate.

CHIASTOSELLA WATERSI, *sp. nov.*

(Plate xviii., fig. 5.)

Schizoporella conservata Waters, 1887 (*non* Waters, 1881), 65, pl. vii., fig. 21.

Description.—Zoarium unilaminate, encrusting, pale brown when dry. Zooecia longitudinally elliptical in outline, the width being less than half the length.

The small, high, semi-elliptical aperture has a straight proximal rim with a narrow, rectangular median sinus equalling in width about one-sixth that of the aperture. Above the distal rim of the aperture four spines are developed.

The frontal is pierced by a small number (10 to 16) of scattered tremopores separated by low, smooth, rounded ridges which pass outward into the interareolar ridges. A single row of small distinct shallow areolae borders the proximal and lateral margins of the zooecia.

Short, acute, small avicularia occur at the summits of small globular bosses, situated on one side of the zooecium some distance below the level of the proximal rim and directed laterally. Usually only one avicularium is found on each zooecium, but occasionally two are present.

The longitudinally elliptical ovicell, with a narrow salient border, has a marginal row of distinct areolae surrounding a central smooth area.

Dimensions.—Zooecium, length, 0.80 mm.; breadth, 0.55; aperture, diameter, 0.15; ovicell, height, 0.35; breadth, 0.30.

Distribution.—Recent: New Zealand.

Cainozoic: Napier (New Zealand).

Observations.—Three slides labelled "*Schizoporella conservata,* New Zealand" (Nat. Mus. Coll. Nos. 65,866-68) were found in the Macgillivray collection. In the form of the ovicell this species resembles *C. gabrieli, sp. nov.,* in its lack of the border of radiating pores, which feature is common to the three remaining species of the genus. It differs markedly from *C. gabrieli* in having a high aperture with a narrow rectangular sinus and the avicularia mounted on squat mamilliform processes. This latter character, in the absence of the ovicell, readily distinguishes this form from those species having an ovicell with a border of radiating pores.

Chiastosella conservata (Waters, 1881).
(Plate xviii., figs. 6, 7.)

Schizoporella conservata Waters, 1881, 340, pl. xviii., fig. 81; *idem,* 1882, 273, pl. vii., fig. 1. Maplestone, 1904, 207.

Chiastosella lamellata Canu & Bassler, 1935, 25, pl. vi., fig. 8.

Chiastosella gibbera Canu & Bassler, 1935, 25, pl. vi., fig. 2.

Not *Schizoporella conservata* Waters, 1887, 65, pl. vii., fig. 21 = *C. watersi, sp. nov.*

Not *Schizoporella conservata* Hincks, 1882, 165, pl. vii., fig. 2; Stach, 1935, 343, pl. xii., fig. 4 = *C. daedala* (Macgillivray).

Description.—Zoarium unilaminate. Zooecia longitudinally elongate, the greatest width being at the middle level of the zooecium.

The small, semi-elliptical, high aperture has a straight proximal rim with a narrow rectangular sinus, equalling in width about one-sixth that of the aperture, overhung by a short projection from the distal extremity of the longitudinal median ridge of the frontal. Above the distal rim of the aperture five or six spine traces occur.

The frontal is pierced by a small number (10 to 15) of tremopores separated by low rounded ridges which pass outward into the interareolar ridges and unite along the longitudinal axis of the frontal to form a pronounced median ridge increasing in height distally until it partly overhangs the sinus of the aperture. Small, shallow areolae border the lateral and proximal margins of the zooecia.

The elongate, very narrow, acute, curved avicularia are developed near the middle level of the zooecium on one or both sides and are directed laterally. The distal portions of the lateral margins of the avicularia are remarkably salient.

The large, oval, salient ovicells have a crescentic, shallow, grooved distal border with about eighteen radiating rows of about three pores. The smooth central area, depressed near the crescentic border, is pierced by three or four tremopores. A spine occurs on each side of the aperture at its middle level where the ovicell joins with the zooecium.

Dimensions.—Zooecium, length, 0.80 mm.; breadth, 0.30; aperture, diameter, 0.12; ovicell, height, 0.35; breadth, 0.40.

Distribution.—Lower Miocene: Victoria: Upper Moorabool River; Mitchell River at Bairnsdale; Clifton Bank, Muddy Creek, Hamilton. South Australia: Mount Gambier.

Observations.—The description given above refers to well-preserved material, slight abrasion resulting in the elimination of the median salient longitudinal ridge on the frontal and the loss of the salient rim and the apparent decrease in size of the avicularia as has apparently taken place in the specimen of *"C. lamellata"* figured by Canu and Bassler.

These authors state that *"C. lamellata"* has four or five spines and *"C. gibbera"* four spines above the aperture. An examination of their figures shows that in the former specimen five to six spines are indicated, while in the four zooecia of the latter form, traces of five spines are discernible. Measurements of the apertures of these two figured forms taken directly from the figures and brought up to the scale of Waters' (1881) figure agree closely with each other and with a large range of Lower Miocene specimens in the Macgillivray collection.

The zooecia figured as *"C. gibbera"* appear to be of different aspect from those of *"C. lamellata"*, but the obliquity of the zooecia and the great attenuation of the avicularia is apparently due to their position near the edge of the zoarium as is illustrated by the zooecia herein figured (pl. xviii., figs. 6, 7) which are both from the same zoarial fragment.

Other minor apparent discrepancies in Canu and Bassler's descriptions of these two "species" undoubtedly have their origin in abrasion effects and variation, and these two forms are regarded as synonyms of *C. conservata* (Waters).

This species is characterized by the small dimensions of the aperture, the five or six spines of the distal rim, the attenuated, acute, salient avicularia and the median longitudinal salient ridge on the frontal, the latter feature readily distinguishing it from those species with a similar type of ovicell.

Chiastosella porosa Canu & Bassler, 1935.
(Plate xviii., fig. 8.)

Schizoporella daedala Macgillivray, 1895 (*non* Macgillivray, 1887), 84, pl. xi., fig. 15. Maplestone, 1904, 207.
Chiastosella porosa Canu & Bassler, 1935, 26, pl. vi., fig. 4.
C. grandicella Canu & Bassler, 1935, 26, pl. vi., fig. 3.
C. parviporosa Canu & Bassler, 1935, 27, pl. vi., fig. 10.

Description.—Zoarium unilaminate. Zooecia rhomboid, usually broader than long, the greatest width being near the middle level of the zooecium.

The moderately large, semicircular, low aperture has a slightly concave proximal rim with a broad semicircular sinus, equalling in width

about one-quarter that of the aperture. Above the distal rim of the aperture four spines are developed.

The frontal is pierced by a varying number of tremopores according to the degree of calcification which has taken place; the tremopores are surrounded by smooth salient ridges which pass into the ridges separating the poorly developed areolae.

Large, acute avicularia occur at the middle level of the zooecia on one or both sides, directed laterally. The distal extremities are attenuated and very salient.

The subcircular raised ovicell has a broad, crescentic, shallow, grooved border with about eighteen radiating rows of two or three pores. The smooth central area, depressed at the margins and raised in the centre, is pierced by three or four marginal tremopores.

Dimensions.—Zooecium, length, 0.70 mm.; breadth, 0.90; aperture, diameter, 0.23; ovicell, height, 0.32; breadth, 0.44.

Distribution.—Lower Miocene: Victoria: Mitchell River at Bairnsdale; upper Moorabool River; lower beds at Forsyth's on Grange Burn Creek, Hamilton; Clifton Bank, Muddy Creek, Hamilton; Flinders bryozoan limestone.

Observations.—This species is closely allied to the genotype, but differs from it in the greater number of tremopores, the more acute avicularia and the much greater number of radiating rows of pores in the crescentic distal border of the ovicell.

Canu and Bassler's figure of *"C. grandicella"* represents a well-preserved specimen of *C. porosa* in which the acute, salient tips of the avicularia and the ridges of the tremocyst are still well shown. In the specimen figured as *C. porosa,* the tips of the avicularia have been abraded and parts of the tremocyst have undergone solution or abrasion, thus giving a different aspect to the frontal. In the specimen of *"C. parviporosa"*, as in most specimens of Bryozoa from the Flinders limestone, the frontal has been subject to considerable solution, thus reducing the size of the funnel-like tremopores by the elimination of the bounding ridges, and the size of the avicularia.

Canu and Bassler give widely varying dimensions for the apertures of the three "species" mentioned above, but actual measurements taken from the figures in question coincide almost exactly. For these reasons, the forms listed above are regarded as synonyms, *C. porosa* being selected because of page priority.

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EXPLANATION OF PLATE XVIII.

(Magnification X 50.)

(All figures drawn with camera lucida.)

Fig. 1. *Chiastosella daedala* (Macgillivray). Ovicelled zooecium from holotype fragment showing form of aperture and adventitious avicularia. Nat. Mus. Coll., No. 64,105.
Fig. 2. *C. daedala.* Zooecium from holotype fragment showing operculum and form of spine. Nat. Mus. Coll., No. 64,105.
Fig. 3. *Chiastosella gabrieli, sp. nov.* Zooecium from paratype fragment. Nat. Mus. Coll., No. 69,639.
Fig. 4. *C. gabrieli.* Ovicelled zooecium from holotype fragment. Nat. Mus. Coll., No. 64,101.
Fig. 5. *Chiastosella watersi, sp. nov.* Ovicelled zooecium and distal zooecium illustrating zooecial detail. Nat. Mus. Coll., No. 65,866.
Fig. 6. *Chiastosella conservata* (Waters). Ovicelled zooecium from Lower Miocene bryozoan limestone at Mitchell River, Bairnsdale. Nat. Mus. Coll., No. 14,063.
Fig. 7. *C. conservata.* Marginal zooecium from the same zoarial fragment as the zooecium represented in fig. 6. Nat. Mus. Coll., No. 14,063.
Fig. 8. *Chiastosella porosa* Canu & Bassler. Distal zooecium and ovicell from Clifton Bank, Muddy Creek, Hamilton (Lower Miocene). Nat. Mus. Coll., No. 14,064.